

A *résumé* is given of the remarkable works that have appeared on the structure of the animals of this group in England, Sweden, and Germany, as well as in France. The interesting question of the part played by, as well as of the origin of, the brown bodies (*grodskaplar* of Nitsche) is very fully gone into. The specialist will know what a subject of debate lies here. Hincks, our best English authority, believing them to be special formations elaborated from the substance of the polyp; Claparède, that they are products of secretion; Nitsche that they are only the remains of decaying polyps. With the last of these views our author agrees: "Le corps brun est un résidu, le reste de la matière qui constituait un polypide après que celui-ci a subi la désorganisation." The nature of the nervous colonial system in the polyzoa is also investigated at full length, and M. Joliet feels compelled to doubt if this so-called system merits this name. The arguments for and against are too technical for us to epitomise. The growth and development of several species were specially investigated, and the entire memoir, to which is appended a list of the species collected (74) at Roscoff during the summers of 1876 and 1877, is well worthy of the attention of all interested in the study of these small but interesting polyps. It will be found in the recently-published *Archives de Zoologie Expérimentale* (Tome 6, No. 2).

STRUCTURE OF LINGULA.—Mr. E. Morsé, Professor of Zoology in the Imperial University of Tokio, Japan, has discovered many facts quite new to science in the life history of this interesting form of Brachiopods. Perhaps the most important is his discovery of the auditory capsules. In the species of *Lingula* investigated, their position and general appearance recall those in certain tubicolous annelids as figured by Claparède. He has also cleared up many points in regard to their circulation, and maintains the absence of anything like a pulsatory organ, the circulation being entirely due to ciliary action.<sup>1</sup> In describing the habits of this species he mentions that, while partially buried in the sand, the free border of the pallial membranes join so as to leave but three large oval openings, one in the centre and one on either side; the bristles then arrange themselves so as to form these openings into funnels which arrest the mucous secretion from the animal, and a continuous current is to be seen passing down the side funnels and escaping by the central one. They can bury themselves very quickly in the sand, and the peduncle agglutinates a sand tube. Prof. Morse exhibited specimens in Boston on December 19, 1877, which had been brought living from Japan; the water had been only changed twice since August 19, and yet none had died. Their viability, therefore, seemed to be great. As Prof. Morse is now on his way back to his professorial duties at Japan, he will have the opportunity of still further prosecuting his researches into the structure and habits of these forms so interesting to both the palæontologist and zoologist.

#### GEOGRAPHICAL NOTES

NEW GUINEA.—A recent number of *Il Movimento* contains a letter from the Italian traveller, D'Albertis, dated from Thursday Island, in Torres Straits, on January 8 last, in which some account is given of his last expedition into New Guinea. Leaving Port Somerset on May 3, 1877, in his steam launch, *Neva*, it was not until the 21st of that month that he succeeded in entering the *embouchure* of the Fly River, where he was well received by the natives. But such was not the case when the *Neva* had advanced a little further up the river, for on June 1 a sudden and unprovoked attack was made on the vessel, and one of the Chinese crew seriously wounded. These attacks were frequently repeated during the further ascent of the river, though always successfully repelled without

casualties. In July and August, when far in the interior, the expedition seems to have been unmolested, but on the subsequent descent of the stream the banks were found again beset by daring and hostile parties of warriors, whose efforts to hinder the return of the expedition brought on frequent skirmishes. Signor D'Albertis was also much inconvenienced by the dissensions of his crew, the greater part of whom deserted him, leaving only five to manage the vessel and to repel the attacks of the natives. Two of these also left him on returning to the mouth of the river, leaving him to accomplish the dangerous navigation of Torres Straits with only the engineer and one sailor. Eventually, however, with aid received from the native teachers on some of the islands in Torres Straits, he succeeded in reaching Thursday Island—now the calling-place of the Queensland mail steamers—on January 4 last. As regards the results of the expedition no details are given in this letter, but from certain expressions employed it would appear that gold in some quantity was obtained. Of this we shall, no doubt, be duly informed before long, as also of the zoological discoveries in which Signor D'Albertis has on former occasions been so successful.

NEW AFRICAN EXPEDITION.—It is rumoured that the Council of the Royal Geographical Society are likely soon to send out a new expedition for the exploration of Africa. The region between Mombasa and Mount Kenia and Victoria Nyanza is mentioned as the probable field of this expedition.

AFRICAN EXPLORATION.—Abbé Debaise, who intends to cross Africa from Zanzibar to the Congo, has received a credit of 100,000 francs from the French government. This sum was voted to him on the proposal of M. Perrin, a radical member, who was supported by M. Gambetta, the leader of the Liberal party. The Abbé will leave Paris for Marseilles in a few days, and thence proceed to Zanzibar. He will be supported by the new Geographical Society of Marseilles, and its president, M. Rambaud, the large Zanzibar trader. News has lately been received in Berlin from the African traveller, Dr. G. A. Fischer, who has traversed since last autumn the tropical regions lying opposite the island of Zanzibar. Despite the hostility of the natives, he has succeeded in making a large number of scientific observations, and has gathered a large collection of zoological specimens, which are now on the way to Berlin. During the present month he starts on a journey up the river Tana.

CAPTAIN ELTON.—We have already referred to the great loss sustained by geography, by the death of this energetic traveller in Ugogo; he died of sunstroke. Mr. Cotterill and Captain Elton had reached this place from the north end of Lake Nyassa, the country traversed being described as very interesting and new to geography. They found the sources of the Ruaha, Usanga, and other affluents of the Lufigi, the Myembe tributary being specially worthy of notice. Mr. Cotterill's narrative will be looked for with interest, as well as Capt. Elton's diaries and map, which have been sent home. The latter, at the time of his death, was H.M. Consul in Portuguese East Africa, and had done work in various parts of the world. He had done good service in helping to clear up the history of African Copal, the produce of *Trachylobium Hornemannianum*.

ANCIENT MAPS OF CENTRAL AFRICA.—M. Richard Cortambert, one of the librarians of the National Library in Paris, has discovered in that establishment a gilt globe, dated 1540, and showing apparently that the course of the Congo was known then to have almost the same direction as given to it by Mr. Stanley. There has also been discovered in the public library of Lyons a globe of 1701, on which are traced in detail the geography of the sources of the Nile and Congo. This globe is said to have been executed by the Fathers

<sup>1</sup> Semper has already fully demonstrated this fact.—E. P. W.

Placide, of St. Amour, and Crispinien, of Toulon, and by the two Brothers Bonaventura and Gregory, all of the Order of St. Francis. Father Gregory, it is said, was the celebrated Lyonnaise geographer, Henry Marchand. In speaking of these discoveries at the Paris Geographical Society, M. R. Cortambert showed that there was nothing extraordinary in them. From the fifteenth century most of the maps make the Congo issue from a great mass of water in the interior of the African continent. No doubt all the information in these old maps was furnished by the Portuguese. M. Vivien de St. Martin is also of this opinion. The Portuguese traders were quite *au courant* with the geography of the interior of Africa, and all the maps, even that of Fra. Mauro (15th century) represent the Nile issuing from lakes to the south of the equator, and give an idea of the course of the Congo, similar to that made known by Stanley. M. St. Martin reminded the Society, moreover, that Ptolemy himself had indicated three immense lakes in the centre of Africa from which issued the Nile and the Congo; only in his map these lakes are placed much too far south. Father Kircher, in his "*Mundus Subterraneus*," published at Amsterdam in 1653, gives a map showing four large lakes, from one of which, called Zaire, both the Nile and the Congo are made to issue. Kircher states that he obtained his information from the General Procurator of the Jesuits for these provinces, who lent him a manuscript of Father Pais. This manuscript may possibly be still preserved in the Jesuit College at Rome.

PARIS GEOGRAPHICAL SOCIETY.—Besides the medals to Mr. Stanley and M. St. Martin, the Paris Geographical Society will give medals to Dr. Harmand for his exploration of the Mekong and the coast of Anam, and to M. Ujfalvy for his travels in Turkestan. The *Bulletin* for December contains an important geographical and statistical article on Kashgar, compiled from various sources by M. J. B. Paquier, an itinerary on the Yang-tse from Shung-shing to Yun-nan-fu, by M. Rocher, and a valuable summary of the geodetic work of the Russian Geographical Society in Asia, by Col. Chanoine.

#### NOTE ON THE DISCOVERY OF THE LIQUEFACTION OF AIR AND OF THE SO-CALLED PERMANENT GASES

IN the Notes on "Recent Science," in this month's *Nineteenth Century*, the writer, in an account of the results of the researches of M. Pictet and M. Cailletet on the condensation of the so-called permanent gases, draws attention to the long-neglected paper of Mr. Perkins "On the Compressibility of Water, Air, and other Fluids," an abstract of which, and apparently the only one with which the writer is acquainted, appeared in Thomson's *Annals of Philosophy*, IV. S., vol. vi., 1823. The paper was intended for the Royal Society, but, being mislaid, was not read at the appointed time. Either it or a second paper was, however, brought before the society on June 15, 1826, and appears in the *Philosophical Transactions* for that year. In this paper, as in the brief record in the *Annals*, Mr. Perkins announces that he had effected the liquefaction of atmospheric air, and other gases, by a pressure of upwards of 1,000 atmospheres, and fully describes the apparatus which he had employed, which is, in principle, very similar to that of M. Cailletet. He thus describes his results in the case of æriform fluids:—

"In the course of my experiments on the compression of atmospheric air by the same apparatus which had been used for compressing water, I observed a curious fact which induced me to extend the experiment, viz., that of the air beginning to disappear at a pressure of 500 atmospheres, evidently by partial liquefaction, which is indicated by the quicksilver not settling down to a level with its surface. At an increased pressure of 600 atmospheres,

the quicksilver was suspended about  $\frac{1}{3}$ th of the volume up the tube or gasometer; at 800 atmospheres it remained about  $\frac{1}{2}$  up the tube; at 1,000 atmospheres,  $\frac{2}{3}$  up the tube; and small globules of liquid began to form about the top of it; at 1,200 atmospheres the quicksilver remained  $\frac{3}{4}$  up the tube, and a beautiful transparent liquid was seen on the surface of the quicksilver, in quantity about  $\frac{1}{2000}$  part of the column of air. On another occasion a second tube was charged with 'carburetted hydrogen' and subjected to pressure; it began to liquefy at about 40 atmospheres, and at 1,200 atmospheres the whole was liquefied."

Mr. Perkins goes on to say: "These instances of apparent condensation of gaseous fluids were first observed in January, 1822, but for want of chemical knowledge requisite to ascertain the exact nature of the liquids produced, I did not pursue the inquiry further; and as the subject has been taken up by those who are eminently qualified for the investigation, I need not regret my inability to make full advantage of the power I had the means of applying."

Mr. Perkins's observations seem to have attracted little attention at the time they were published, and have since been, apparently, almost forgotten. Although they do not in the least detract from the great merit of M. Cailletet's work, they undoubtedly have their place in the history of this subject of the liquefaction of the gases.

It may be worth while to point out that the statement that all the gases known to the chemist have now been liquefied is not strictly true. The most recently-discovered of these—phosphorus pentafluoride—has not yet been seen in the liquid state, although there is not the least reason for believing that it will constitute an exception to the general law.

T. E. THORPE

#### HELMHOLTZ'S VOWEL THEORY AND THE PHONOGRAPH

THE following experiments with the phonograph are of interest as throwing light on the nature of vowel sounds:—

Let a set of vowel sounds, as A, E, I, O, U (pronounced in Italian fashion) be spoken to the phonograph in any pitch, and with the barrel of the instrument turned at a definite rate. Then let the phonograph be made to speak them, first at the same rate, and then at a much higher or lower speed. The pitch is, of course, altered, but the vowel sounds retain their quality when the barrel of the phonograph is turned at very different rates. We have made this experiment at speeds varying from about three to one, and we can detect no alteration in the quality of the sounds.

According to Helmholtz, the characteristic quality of each vowel is given by the prominence of a constituent note or notes, of definite or approximately definite absolute pitch, in the sounds uttered. Now obviously, the absolute pitches of the constituents of the vowel-sounds in the above experiment were all altered in the same proportion, so that the absolute pitch of the prominent notes varied greatly; but yet the vowel quality was unchanged. This experiment, therefore, appears to give results in contradiction of Helmholtz's theory as we understand it.

At the same time we have found, in the course of experiments, of which a full account will shortly be communicated to the Royal Society of Edinburgh, that if a scale be sung to the phonograph with one vowel sound, such as O, the wave-form of the marks on the tinfoil does not remain unchanged at all pitches. We have not yet had time to analyse the curves so obtained into their harmonic constituents. Such an analysis will show whether the changes we have observed in the wave-form as the pitch rises, are due to a change in the relation of the amplitudes of the constituents present, or only to a variation of phase.

Edinburgh, March 11

FLEEMING JENKIN  
J. A. EWING